Strategies for Embodied Design: The Value and Challenges of Observing Movement

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ABSTRACT

In this paper, we investigate the value and challenges of observing movement experience in embodied design. We interviewed three design researchers selected from a CHI2014 panel on designing for the experiential body. For each designer, we analyzed a publication describing their process of observing movement experience. By analyzing the interviews and publications, we studied how these researchers observe movement and how they articulate it in their design process. From our study, we contribute a set of techniques for performing movement observation inspired by somatics and body-based practices which we define as: attunement, attention, and kinesthetic empathy. We illustrate how these techniques have been applied by the selected researchers, and also highlight the remaining challenges related to articulating, translating, and sharing the felt movement experience in the context of design within HCI. Finally, we address these challenges by arguing for further exploration of movement frameworks from the fields of somatics, body-based practices, and movement studies as specific strategies that can be applied to HCI.

Author Keywords

Observation, Movement, Empathy, Interactive Systems, Design, Evaluation

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

INTRODUCTION

CHI2014 in Toronto included a panel entitled "Designing for the Experiential Body" [27]. The panelists, prominent design researchers within the CHI community, facilitated a discussion on how the community could embrace the full range of "rich body/movement-based experiences" in the design of

embodied interactions [9]. The panel discussion illustrated the promising perspectives of "moving beyond treating our bodies as mere input-output machines through impoverished interaction modalities, towards richer, more meaningful interactions based on our human ways of living in the world" [27]. It also indicated that this community of knowledge and practice is facing multiple questions and challenges in bridging between such rich movement experience and the digital realm. Researchers within HCI lack common tools to describe, translate, and transmit the felt movement experience collected in self-observation and observation of others, and apply this experience to a design process.

In this paper, we seek to address the following questions: 1) How do the design researchers focusing on the experiential body observe movement? What is the nature of the action of observation? 2) How do design researchers articulate the observed movement experience? How do they describe it? And how do they implement the data collected from their observation of the 'felt' experience in order to transform their design practice?

To investigate these questions, we interviewed three design researchers that organized the CHI2014 panel titled "Designing for the Experiential Body" by discussing how they perform observation to collect movement experience, and how they articulate these experiences. We correlated their individual responses with a key publication they had each written that emphasized the use of observation in their design process. We unpack the ways in which these researchers perform and integrate movement observation into their design for movement experience. We contribute a set of techniques for performing movement observation inspired by somatics and movement studies. The techniques we highlight are: attunement, attention, and kinesthetic empathy. While our paper is based on existing techniques illustrated in our multidisciplinary literature review, we contribute by bringing them from somatics and articulating them in HCI. We show explicitly how these techniques are implicitly used by these researchers to perform self-observation and observation of others in the design for embodied movement experiences. Following this, we extract the challenges described by these researchers that relate to articulating movement experience in the context of design within HCI. We address these challenges by arguing

that the HCI community focusing on the experiential body could further explore the development of observational movement frameworks. More generally, we argue that the community would benefit from developing movement literacy and deepening its physical and theoretical movement knowledge and related design strategies. We suggest that such knowledge can come from integrating the fields of somatics and movement studies with the domain of interaction design. These fields provide experiential and analytical frameworks to perform observation and describe movement, which can provide new strategies for developing movement awareness within HCI [35].

LITERATURE REVIEW

In order to ground our study in prior works within HCI, we review the literature and present the differing approaches to observation that apply to movement experience.

Using Observation in Designing for Movement

HCI literature is rich with methodologies using objective or subjective [21] measures and other third-person perspectives, such as Cartesian observation commonly used in scientific methods. However, alternative modes of observation exist and shifting between them allows designers to attend to different qualities of the same event [35]. Schiphorst proposed an approach to observational techniques within HCI that incorporated a continuum between first, second, and third-person observation [35] as suggested by Depraz, Varela, and Vermersch in their book "On Becoming Aware" [8]. *Third-person* perspectives posit observation as objectively gathering data from the world that removes the bias of the self. *First-person* perspectives are focused on self-observation and exploration of one's own experience in developing and testing technologies. They seek interactions that afford self-connection. *Second-person* perspectives include participant observation through kinesthetic empathy. These observational methods facilitate collaboration and build a shared knowledge to connect to others' experience. Finally, Schiphorst proposes an additional technique of "observing through the self into the world", a form of second-person observation based on the "mirror of the self" technique developed by Christopher Alexander for observing relative wholeness within a situation, action, or object [1].

Third-Person Perspective

Among methods using third-person perspectives in HCI, ethnographic research methods have gained increased traction due to their ability to connect cultural and social knowledge within interaction design. They provide an interpretive description of users, environments, interactions, and the context of use. They also describe the "bias" toward understanding the use of the system from the investigator's perspective. Ethnographic methods include field work performed in natural settings deployed during the whole life cycle of development, from gathering users' needs to onsite evaluation [16]. They help make informed choices about what to study, who to observe, what activities to record, and how to analyze and integrate the data into valuable findings. Millen argues that, more than a method of field data collection, "ethnography is rather a form of analytic reportage, with the ethnographer acting as a translator or cultural broker between the group or culture under study and the reader" [30]. Ethnographic methods have also helped to bridge the gap between third and second-person methods in interaction design through the inclusion of Cultural Probes [13].

Second-Person Perspective

Second-person perspectives include participant observation through kinesthetic empathy. This phenomenon bridges the self to others by connecting one's bodily sensations to others' experience. John Martin was one of the first to describe this phenomenon in the 1930's: "We shall cease to be mere spectators and become participants in the movement that is presented to us, and though to all outward appearances we shall be sitting quietly in our chairs, we shall nevertheless be dancing synthetically with all our musculature" [26]. Research surrounding kinesthetic empathy has grown since the discovery of mirror neurons in 1996. Mirror neurons are activated in the brain both when observing and performing movement. Neuroscientists have found that both our visual and physical familiarity with movement heightens neuronal activity when observing movement [4]. How this neuronal activity relates to one's perception and attention to movement is still unclear. However, mirror neurons may provide one possible neurological explanation for kinesthetic empathy. Qualitative studies in dance have demonstrated that movement observation can affect our bodily state by triggering physical responses [34]. Studies using eye tracking and TMS+EMG have also found that our physical and visual movement literacy play an important role in how we perceive and empathize with movement [36, 17]. This research demonstrates the importance of the body and movement literacy in the observational process.

Kinesthetic empathy research has recently been acknowledged and incorporated into design frameworks. For example, Moen developed a framework for kinesthetic movement interaction that creates pleasurable movement experiences [31]. Her framework is inspired by theories in dance developed by Blom and Chaplin [3]. It includes design considerations relating to increasing kinesthetic awareness and expressing kinesthetic empathy [31]. Fogtmann et al. developed a conceptual framework for analyzing whole-body movement interaction through outlining design themes and parameters including: *Kinesthetic Development*, *Kinesthetic Means*, and *Kinesthetic Disorder* [12]. *Development* refers to creating interactions that improve kinesthetic skills. *Means* refers to reaching other goals, unrelated to kinesthetic development. *Disorder* refers to the transformation of a kinesthetic sensation. Finally, Wright et al. used empathy to define characteristic of designer-user relationships when designing for user experience [37].

First-Person Perspective

Because of the often intimate nature of designing for experience, it has mostly been approached in the literature from a first-person perspective, which involves self-observation and the self as a lens to observe others' experience [29]. However, it is very difficult to gain access to experience. According to Damasio, we have access to different forms of knowledge in

different states. In order to observe, one needs to "capture" the data using one's sensorial modalities, filter it and articulate it through one's own experience [7].

In accessing experience, there is the challenge that one may not have the practiced skills of self-reflection [8] nor the adequate vocabulary to articulate one's own experience [14]. To address this difficulty, methods have been developed in the domain of cognitive science where the researcher acts as a facilitator to help articulate the subject's experience [18], using her own knowledge of the phenomena. Care is taken to construct questions using the subject's own words to avoid influencing her answers. The researcher helps the subject to achieve a mental state of re-living the experience by using "markers" in the form of statements and by focusing the questions on the physical sensations being experienced during these particular moments. This reflection allows the subject to authentically describe her process and avoid interpretations of her experience from an objective stance [33]. This is similar to the practiced reflection achieved in first-person phenomenological description [8]. Kozel proposes a methodology for first-person phenomenological observation with repeated reflection over time [19]. It consists on recording an initial, raw, visceral response to the lived experience, then letting the experience sit, revisiting the memory of that experience, and recording the new response after time has passed. Kozel suggests that evaluating phenomenological experience starts with an open and uncritical sensory information. This methodology has been applied to movement observation by Corness et al. [6]. According to Kozel, a method of evaluating experience arises from iterating such as extensive journaling and reflection.

Developing Movement Literacy
We are all expert observers of movement. All humans learn and develop the capacity to observe movement because it is fundamental to existing in the physical and social world. However, there is a difference between the observation of which there is little conscious awareness, and an articulated observation used to describe and analyze movement experience. The latter kind of observation is a skill that can be trained and practiced by developing movement literacy and deepening the physical and theoretical movement knowledge. This was found by Moen to be central when designing for a movement experience [31]. According to Moen, designers must have physical knowledge of the movement they are designing for. Moen argues that movement literacy should be gained through movement exploration and reflection on these experiences. As shown previously, the need to develop movement literacy in HCI, and particularly when designing for movement experience, correlates with recent findings in neuroscience showing that observation is influenced by our prior movement knowledge, physical, visual, and theoretical [4]. Over centuries, dance has built a strong practical and theoretical body of knowledge for performing and crafting movement. This has inspired recent works in HCI to draw upon theories in modern dance [31], and to directly collaborate with experts dancers and choreographers to formalize a movement vocabulary for interaction [10].

Other fields, such as Somatics, build acute skills of movement experience, observation, attention, and synthesis. The term somatics is derived from the Greek word "somatikos", soma: "living, aware, bodily person" and refers to body-based practices that use a first-person perspective to develop embodied awareness of body sensation and capacity as experienced and regulated from within. In *"Self-evidence: applying somatic connoisseurship to experience design"*, Schiphorst argues for the necessity of somatic connoisseurship in experience design [35]. For example, Loke and Khut utilize their somatic practice of Feldenkrais methods to design technologies that enable the users to gain awareness of the inner bodily sensation [23]. Feldenkrais methods are somatic practices that provide frameworks to describe small-scale body interactions and micro-movements [11]. Recently, researchers explored the benefit of Somaesthetics in designing for the body. This technique involves somatic introspection, meaning "an organized inward-looking inquiry by the individual about his or her bodily perception and its related affective experiences" [22]. Lee et al. used somaesthetics practice to improve the ideation process of interactive product design through a set of movement and design workshops.

Laban Movement Analysis (LMA) is a system that focuses on experiencing, observing, and articulating movement patterns. LMA per se is not viewed in the same way as practices that are primarily somatic such as Alexander Technique or Feldenkrais. It has a broader scope because it provides a rigorous use of language to analyze functional and expressive movement of any scale based on experiential knowledge and strategies. It describes movement in terms of Body (What is moving?), Effort (How is it moving?), Space (Where is it moving?), and Shape (What relationship with the environment?) [20]. In HCI, LMA was exploited to define interaction scenarios that offer the user an aesthetic exploration of movement qualities through Laban Effort [25]. Loke et al. include LMA in their "toolkit" as a way to describe movement in the design and evaluation of movement-based interactive systems [24]. Their "toolkit" offers methods and tools organized by activity, from the three perspectives of the mover, the observer, and the machine. In total, they propose 7 activities that can be used at each stage of the design process based on Investigating, Inventing and choreographing, Re-enacting, Describing and documenting, Visual analysis and representation, Exploring and mapping, and Representing machine input and interpreting movement. They use LMA to visually analyze and represent the moving bodies. Drawing upon the approach proposed by Loke et al., we suggest that LMA can be used for all of the above activities requiring an accessible form of movement experience, investigation, inquiry, and observation in design.

ANALYSIS OF THE EXPERTS' PUBLICATIONS
We selected three prominent expert peers, Kia Höök, Georges Khut, and Helena Mentis, because of their specific interests in movement experience. They are design researchers and practitioners whose research interests align with our research investigation on observation in designing for movement experience. They are among the rare design researchers whose practices are inspired by somatics, without having ever been

our co-authors. They all look at movement from an experiential lens and are inspired by first and second-person methodologies in order to design body-centred interactions. We selected three specific publications from their publication record that they considered to be key illustrations of their practice, whether they are shared or single authored. The selection criteria required that the publication emphasize the use of observation in creating embodied interactive systems.

We were particularly interested in the researchers' observation process in the context of a specific design work and publication outcome. The design works that we analyzed are already published. Yet the novelty of our contribution is to highlight how the observational process implicitly encompasses our technics. Thus, our analysis of the publications advance our knowledge about the source papers and contribute to the larger field of embodied interaction.

In her paper "Transferring qualities from horseback riding to design", Kia Höök [15] analyzed her experience of learning horseback riding to understand and identify types of movement experiences. Using an auto-ethnographic approach, Höök emphasizes the need of body-centred design to better address bodily experiences. As much as ergonomics exemplifies the functionalities related to the body, interaction design should address the experience sensed and felt through the body. From her reflection, Höök extracted themes relating to her experience and showed how these might be considered in body-centred design processes. Höök describes differences in experiences between seeing her body as an object, experiencing through and in the body, and becoming a "centaur" or one with the horse. She describes the importance of finding ways to describe bodily experiences of interactions that can serve as a resource for design. However, Höök also acknowledges the challenges in translating these experiences, stating, *"Still the experiences I am trying to describe are wordless, and putting detailed descriptions of them still fails to cover the complexities and uniqueness of my embodied experience."*

Loke and Khut apply the Feldenkrais Method to explore touch and proprioception in their interactive artwork, *Surging Vertically* [23]. Loke and Khut were inspired by Feldenkrais Awareness Through Movement (ATM) lessons. In these sessions, a certified practitioner leads participants through a series of exercises designed to heighten awareness of movement sensations. Loke and Khut integrated the ATM Feldekrais lessons into their design. A ten-minute recording of an ATM lesson is played to the participant. The recording draws the participant's attention to sensations of weight throughout the body and asks her to reflect on how these sensations intertwine when moving in varying ways. After the participant has listened to the recording, a human aide pulls on a rope connected to her feet. This change in tension invites participants to rise and shift their weight forward on the balls of their feet. *Surging Vertically* allows participants to inwardly reflect on their movement experiences. The Feldenkrais Method provides a framework to invite this type of reflective, embodied interactive experience.

Mentis et al. utilized the expertise of a Certified Laban Movement Analyst to design for the body. The goal of the authors was to create a system that enables interaction based on movement qualities. They interpreted movement qualities through the lens of LMA Effort and designed a system where changes in Effort Qualities were measured using a *Microsoft Kinect* and triggered musical events. A user study was conducted to understand how participants experienced, perceived and described the interaction. The LMA expert was also interviewed to gain insight on how she identified Effort qualities in the movement. The LMA expert was able to bring a more "embodied vision" to the observational process and often she would perform the movement while observing [28]. Her observation process relied on negotiation and interpretation when viewing the whole body moving. This was achieved primarily through the expert's own body and kinesthetic engagement. One challenge in building their system, as described in the paper, was how to articulate a movement experience and sensation. LMA, as they found, is one tool to aid in this translation.

Höök, Loke and Khut, and Mentis all stress the importance of personal *experience* in their design process. Höök breaks down experience by analyzing her own process of learning horseback riding and distinguishes between outer and inner relationships in her experience. As shown by Loke and Khut, the Feldenkrais Method provides a rich framework that allows users to inwardly experience through the body with a focus on self-discovery. However, as stated by both Mentis and Höök a challenge still remains in how to connect the inner *sensing* self with the outer *thinking* self, as the process of reflecting and bringing to conscious awareness is largely a thinking practice. As Mentis found, utilizing the embodied knowledge of an LMA expert can help bridge this gap. Mentis chose to focus on the LMA Effort category in her interaction design process. While LMA Effort is one important expressive component of movement, we suggest that LMA as a whole can provide a rich observational and analytical framework allowing to access and shift between both the inner *sensing* and outer *thinking* of movement experiences, which supports creating embodied movement-based interactions.

METHODOLOGY

In this study, we interviewed the three design researchers to investigate the ways in which they observe and articulate movement experience. The interviews were performed in relationship to a specific design process that emphasizes the use of observation and that is described in their relevant publication. Our analysis of the publications was also correlated with the researcher's responses in order to support the analysis of the interviews.

Foci in Movement Observation

We define 4 main foci as important aspects of movement observation. These foci encompass 3 *observational techniques* used in somatics and LMA to observe human movement [32]; attunement, attention, and kinesthetic empathy. These techniques are concrete procedural instruments of active observation, which is the action of being consciously aware of the observational process. We developed these foci from our

analysis of the literature and by articulating well-known practices of observation in the field of movement studies, and particularly LMA in which we are trained and certified as Laban Movement Analysts. Our last focus concerns the *implementation of observation in the design for movement*. Our 4 foci frame our collection and analysis of the data on the researchers' observation process.

- Observation techniques. Through our interviews, we investigated the techniques used by design researchers to observe movement experience. We were particularly interested in how they used the following techniques:

    - Attunement: The preparation to perceive sensory information in an integrated cognitive state. It's an operation in which the observer accommodates herself to another by shifting her behaviour to the situation, process, or qualities of the other [2]. Many people implicitly attune as a preparation to engage in everyday activities and to make themselves ready to receive information. Examples could include a surgeon taking a deep breath before beginning surgery or a runner closing her eyes before beginning a race.

    - Attention: The "flashlight" used to bring awareness to facets of experience. Schiphorst describes attention as the operator on experience [35]. What people pay attention to, and how they guide their attention, directly affects what they will see.

    - Kinesthetic Empathy: The phenomenon related to how the body physically responds when observing movement. What the observer's own physical response is to someone else's movements, and how it guides her attention into someone else's patterns.

- Implementation of observation. In addition to the elements used by researchers in active observation of movement, we were interested in investigating how they deployed these elements in their design practice.

Data Collection

In this study, we collected data on the observation process of the three design researchers that we selected.

Two authors of the paper performed open-ended interviews, in a room at CHI2014 venue in Toronto, at a scheduled times after the conference. We chose a conversational approach to qualitative interview techniques. Following a phenomenological methodology inspired by Depraz, Varela and Vermersch [8], we asked researchers to access the experience of movement observation, and then describe it in the context of the specific design related to the publication that we selected from their academic dissemination. All the interviews were recorded by a digital audio recorder. Each interview lasted about 40 minutes.

Our questions aimed at helping the researchers to achieve an authentic reflection about their process related to the 4 aspects of movement observation that we defined. Our questions included:

- An opening question: Can you talk about how you observe movement in your design approach [described in your paper]?

- A question about attunement: How do you prepare to observe yourself or the users' movement?

- A question about attention: What do you pay attention to?

- A question about kinesthetic empathy: If you could replay the experience [described in your paper] of observing movement, could you describe your sensations (alt: how your body feels?)?

- A question about implementation of observation: How/when/why does movement observation inform your design practice [described in your paper]?

Data Analysis

We analyzed the data collected from the interviews using a methodology inspired by grounded theory [5] that consists in the six investigators (the authors) coding the responses separately and correlating their results:

- Axial coding: All investigators listened to the interviews independently and analyzed the related publications. They extracted keywords and key concepts that define the data using the interviewees' language. The six investigators discussed all individual codes and through a member checking process formed a collaborative code.

- Selective coding: All investigators collectively extracted high-level categories (techniques, tools, etc.), during a focus group. They applied different colors to each category and then linked the data organized in the axial coding across the high-level categories using the color codes. They then compared the results across subjects. This constituted the 2D cartography of the data.

- Theoretical coding: The investigators collectively mapped the 2D cartography of the data to the 4 original observation foci used in the interviews (attunement, attention, etc.) and constructed a 3D cartography unfolding the data as shown in Figure 1.

From grounded theory, we used axial and selective coding to allow relevant and unexpected elements of observation to emerge from the analysis of the data. For example, it allowed us to articulate the remaining challenges in framing movement observation in HCI, which were not one of our foci. In the theoretical coding, we mapped our pre-defined observation foci (attunement, etc.) to the data connecting the various levels of analysis. We believe that this is a more in-depth and all-encompassing methodology that allow to unpack the researchers' observation process and extract the remaining challenges in the implementation of observation in the design for movement experience.

ANALYSIS OF THE INTERVIEWS

All three researchers stressed in the interviews the importance of the personal felt *experience* in their design for embodied technologies, which correlates with our analysis of their paper. They adopt a first-person perspective for self-observation

and second- and third-person perspectives for observation of others.

In the following sections, we first present the qualities that we identified from the analysis of the interviews, that emerge from their approach to design from the felt experience. We then present the techniques and tools used by the researchers to perform observation of themselves and others, organized according to the first-, second-, and third-person perspectives that were articulated in HCI by Schiphorst [35]. The techniques that we present go beyond describing the researchers' perspectives in observation; they also illustrate their perception of their action of observation. Following that, we present the remaining challenges of movement observation and articulation in designing for the experiential body. Our findings are elaborated in a narrative way, supported by direct quotations from the interview transcripts.

The Qualities of Designing from the Felt Experience

Designing from the felt experience allows to build embodied technology that supports self-connection and affords a kinesthetic self-awareness.

The researchers that we interviewed adopt a first-person perspective to design technology that supports self-connection. For example, Georges Khut's installations displays digital media such as visuals, sound, and biofeedback that respond to the participant's physiological states captured using biosensors. They allow the participants to gain a kinesthetic awareness of their inner bodily sensations by interacting with the technology. He defined his installations as spaces in which: *"you have to feel it in your body, the nervous system and your brain, so you have an intention, then you have some feedback signal that you are hearing in the moment." (Khut)*

Designing from the felt experience opens for new embodied experiences.

Georges Khut's installation aims to provoke novel embodied experiences and *"create a costume that extends the body." (Khut)*. According to Höök, such technology opens for new embodied experiences. She suggest that researchers *"need to be open to what the digital material is giving". (Höök).*

Designing from the felt experience allows for great design qualities to emerge.

Feldenkrais methods allow Kia Höök to access her inner felt experience, which ameliorates the qualities of her design for movement experience: *"It helps to be more sensitive [...] It focuses you and it makes you land in yourself, it makes the design process way more honest, more slow and reflective and better". (Höök).*

Höök argues further that designing from an awareness of inner experience allows for such qualities to emerge in any design approach: *"It doesn't have to be that you are designing for something physical, it doesn't matter what you are designing for." (Höök)*

Similarly, Mentis acknowledges the qualities of designing from the felt experience: *"And the design is something that embodies the data that we are all mingling. Perhaps that will*

not only solve the problem but also present you opportunities, almost solving a problem that many people didn't know that they had". (Mentis).

The Techniques and Tools Used for Observation

First-person perspective
In order to develop embodied technologies, researchers pay attention to their own bodily felt experiences as a starting point.

Kia Höök's designs for the body, starting from her own body and from her embodied felt experience: *"There is a process where you are allowing yourself to go into that felt experience, and then come out of it and then you can articulate and conceptualize" (Höök)*. She engages her whole design team in gaining awareness and attending to their own bodily experience by inviting them to attend Feldenkrais sessions, that benefit the whole design cycle: *"It's a typical Feldenkrais session, 30min 40min 1h, and then for the tech testing, she [the Feldenkrais instructor] records her voice and we reuse that, or we do it without her voice and try to go through a body scan or something with the technology." (Höök)*

Khut uses as a starting point his embodied states to define those which the participants access in his interactive installation: *"As the kind of maker you are trying to find some way of drawing the technology alongside you." (Khut)*

To access their own bodily felt experience, researchers attune to themselves.

Höök is not only observing and reporting on her actions, but further gaining awareness of her own inner embodied experience by attuning to herself and to the horse. She reports on the shift in her self-observation from a remote observation of herself related to an outer attitude, to a inner observation related to an embodied felt experience of herself with the horse.*"I was looking at my body from the outside in a sense and I was re-adjusting something I was doing wrong, till I get it. So that's one experience, but another experience is once I become in sync with the horse, when we are one." (Höök).*

Khut describes how he accesses a kinesthetic awareness of himself during the conception of his installation by attuning to himself: *"I start to internalize or hear sounds or imagine some textures and think of how that would relate to a quality of breathing. It's very kinesthetic in that moment of conceiving the piece"(Khut)*. Khut also attunes to himself when testing his interactive installation, by calming down and using slow breathing: *"I had to plug myself in, keep trying it out and fine tuning it [...] And you just have to be what you want the interaction to be. Its about trying to afford this sense of focused calm and really slow breathing". (Khut)*

To observe and reflect on their own bodily experience, researchers use various tools. These can help transition between inner and outer observational states.

Höök reported during the interview on the use of video as a tool to observe and reflect on her own experience of learning horse back riding [15]: *"I did videotapes of myself and asked my teacher to look at the videos and comment on them. I*
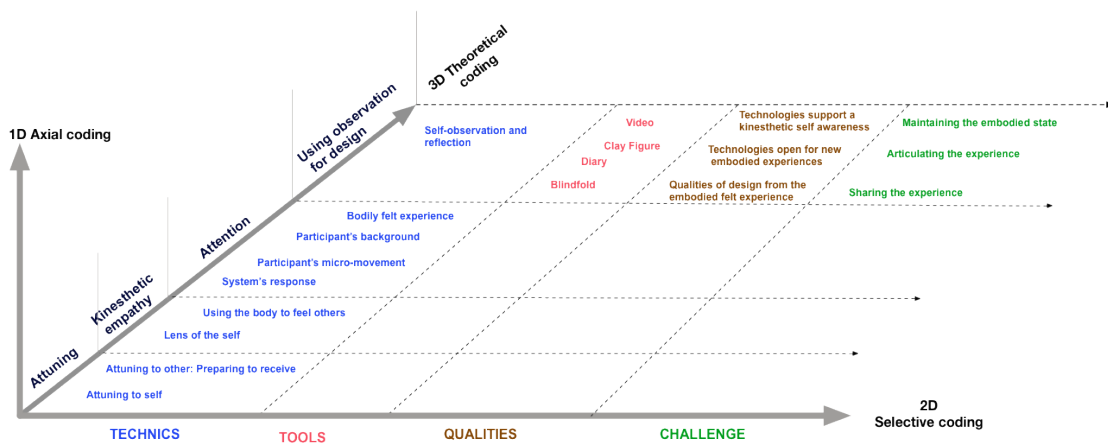
Figure 1. 3D cartography unfolding the data

took notes every time I have been riding, as detailed notes as I could. I had a camera on my helmet that was wiggling around, I put a camera on my teacher. I did everything I could think of to try and work on it." (Höök)

A diary can help an observer become aware of how she uses the lens of the self by identifying her bodily state and attuning to others. *"...I wrote my own diary on the side [...] I would go and do my observations for a few hours a day and then I would come home and I would put down some of my feelings, how I felt. Things like my stress about what is going on in my own life [...] affected me as an observer."* (Mentis)

Using a blindfold can help to kinaesthetically observe others by bringing attention to senses other than seeing. *"...you need to be blindfolded, and then you experience materials, and other forms and articulate and elaborate about that..."(Höök).* Researchers use models, such as schematic body or clay figures to transition between inner *sensing* and outer *thinking* about the movement experience: *"We start by having a big sheet with a schematic body from different angles and then write down sort of what we are feeling before the Feldenkrais and then we do the Feldenkrais and then we do a reflection on the same form and then we used clay. So we do a clay figure before we do the Feldenkrais and we do a clay figure after."* (Höök)

Second-Person Perspective
To observe the participants in the system, researchers attune to others by preparing to receive movement information.

According to Mentis, to observe movement, it is important to be receptive: *"Observing requires us to prepare ourselves to receive the information."* She describes her observational process as *"just seeing"* by *"allowing something to happen."*

Attuning is the preparation to receive information and "take in" the different patterns that emerge. Once one is able to attune to herself and to others, then empathy can allow access to an embodied understanding of others through one's own feelings and sensations. Thus the observer shifts into a state of observation of others through the lens of the self using the ability to access kinesthetic empathy.

Researchers use kinesthetic empathy; they use their body to feel the participant.

Kinesthetic empathy is defined by Mentis as a technique to feel the participant through her own body and physical sensations. Kinesthetic empathy allows to observe others through the lens of the self: *'"I am using my body to feel what other people are feeling instead of using my mind to create a story in my head to make me feel the other's story." (Mentis)*

Mentis reports on how her practice of Alexander Technique allows her to develop the ability to connect her bodily sensation with the observed movement: *"She [the Alexander Technique facilitator] was making these changes and yet I could feel what these changes felt like on the inside, they felt very strange and I felt very disembodied from it [...] But then she went around to work on the rest of the group and I saw! I started seeing what was happening!" (Mentis)*

Researchers acknowledge the importance of the lens of the self in observation.

Mentis argues that the lens of the self is not a bias but rather a technique to observe others. *"I'm observing, I'm affecting the environment and I'm being affected by the situation, I can't subtract myself from that situation. I definitely can't be objective in that environment." (Mentis)*

The lens of the self allows Mentis to grasp the participant's micro-movements and "read" their emotions by connecting them to her own feelings and bodily sensations: *"You feel that moment of stress, exhaustion, anxiety of the eyes [...] The tingle you feel in your body and sometimes you can't always specify what you're hearing or whats giving you that sense. [...] I should be able to read emotion and be able to see it in the work that people are doing." (Mentis)*

Third-Person Perspective
To observe the participants' experience in the system, researchers pay attention to the larger patterns: the participants' backgrounds rather than their direct actions.

The participants' backgrounds reveal their experience of the interaction with the system: *"The embodied part of using the*

system had nothing to do with using the system. It was everything else that happened. You had a couple that came to the museum together. Are they a close couple? Are they an old couple? Do they have a history together and they want to move through the art exhibit together? Or are they just friends who are happy to separate and come back together?" (Mentis)

Researchers pay attention to the smaller patterns: participants' micro-movements as indicators of their state.

Mentis pays attention to participants' micro-movements to observe their emotions: *"The most important thing when I am observing someone is trying to spend a lot of time not looking at his gross motor movements, which is usually what a neurologist is looking at. I am usually looking at all the small things, the little flutter across the face, the hunching of the shoulders. Someone's small hesitation." (Mentis)*

Researchers pay attention to the system's response as an indicator of the participants' state in the interaction.

Unlike Mentis, Khut's attention is drawn towards the system's response to observe the participant's inner state in his artwork: *"Its more observing the artwork [...] I'm not so sensitive to how people are, I could probably become more aware of how people are breathing, but there are a lot of people around just staring at the screen. I am just kind of observing and speculating." (Khut)*

The challenges in implementing observation in design
It is challenging to maintain the inner embodied state during the design process

Höök argues that designing from the felt experience requires to be in an inner embodied state during the design process. However, maintaining that embodied state when developing the interactive system is challenging. Höök considers that verbalizing and conceptualizing the inner felt experience into an outer design idea "loses" the embodied state. *"My feeling is that we do the Feldenkrais sessions and it is lovely and then we talk about it and the designers in the group have this urge to put some words down, because that's how they are used to do in design, you have few words, or concepts that you keep returning to in your design process. When you are evaluating design alternatives. And for me that breaks [...] I don't know how to bypass that, because it loses some of the bodily experience." (Höök).*

Khut and Mentis also raise the issue of shifting between an inner embodied state into an outer design mode. Technologies such as accelerometers are described as "rigid" because they do not maintain the embodied state that designers target: *"I feel that I can gather some really rich stories of people where they use their bodies. And then when I go to design, I'm not able to feel what I design because I feel that I am working with technology that is very rigid [...] I think that I am in it, and then I will use this accelerometer and I will use this data and then I have lost it." (Mentis)*

"You really have to consciously shift your nervous system arousal, then coming out of that and doing all that typing

again, it was very interesting to move back and forth between those two modes." (Khut)

Höök mentions that in order to overcome this issue, she is exploring the *"use of something that reminds you of the bodily experience that you have had"* during the design process.

The descriptions of the researchers show a disconnect between an inner process of *sensing* the body and an outer process of *thinking* and articulating design ideas that arise from the bodily experience. They are experiencing the inner/outer as a polarity rather than as a continuum.

It is challenging to articulate the inner felt experience using language.

According to Mentis and Höök the biggest challenge is to articulate the observed movement: *"The harder part was finding ways to articulate what I was seeing." (Mentis)*

"Once I become in sync with the horse [...] I don't think I can articulate what's going on because I am not thinking at all." (Höök)

Höök *"struggles"* to find the tools to describe the bodily experiences in order to translate them into design ideas while maintaining an authentic embodied state. *"I felt like there were so few descriptions that also include the real corporal body. You know, the sitting bones. We have been looking at Laban. I wanted to give a rich thick description of all of it and how it would all come together. I was really struggling with that. It was really difficult. This articulation process, how do you go from these experiences that happen rapidly and that are dynamically shifting, and they are in the moment and they are physical? How do you go from that into a description that can be operationalized and turn it into design ideas? And how can you be honest in your description?"(Höök)*

She argues that the existing languages to describe movement such as LMA do not provide the level of detail in the description that she needs. Moreover, using language to articulate the inner felt experience disconnects her from the authentic embodied inner state. Therefore, she does not advocate for the use of language and rather takes a detour from language and attempts to translate her inner experiences directly into design concepts: *"You don't have to conceptualize or put names on the different movements or things that you are doing because your brain is decoding these things anyways." (Höök)*

It is challenging to share the inner felt experience with participants and collaborators.

Khut's goal is to build systems that allow him to share his own intimate embodied states for participants to experience through the technology: *"It's a feeling like this sense of what would it be like if I could make this experience emerge from inside me." (Khut).*

However, there are challenges in designing systems that support sharing the intimate state with the participants through the technology. *"[...] so the design challenge is to create a sound that affords that state [the state of the designer]. And what does it mean then if you are trying to design for a tra-*

jectory, say what would it mean if you were trying to stay elevated?" (Khut)

Sharing the embodied experience is also challenging when collaborating with other designers in developing the technology: *"As a producer, and as a collaborator, you learn about how you draw those collaborators into understanding that embodied experience. A lot of the time they just don't want to do it or are resistant, they are just like tell me what you want me to do and I'll do it." (Khut)*

Although sharing one's own embodied state with collaborators remains a challenge in practice, Höök acknowledges its value in terms of building an interactive system collaboratively, departing from the shared presence and bodily experience: *"The presence of the other in the room is totally changing the experience. And so it's the only time that we [the collaborators] can talk about it and fine-tune what it is that we are trying to design for."*

DISCUSSION AND FUTURE WORKS

Our findings show that, although these researchers observe themselves and others by using **attunement**, **attention**, and **kinesthetic empathy**, they are challenged by the application of their observations to the design process itself.

The first challenge for researchers is **to stay engaged with their inner embodied insights** (those insights that emerge directly from inner felt experience) during the design process. The second challenge for researchers is to **articulate inner felt experience through language**. Articulating experience through language is elusive: there are many languages, but not all are suitable to translate inner bodily sensations to outer design concepts which arise from these experiences. The third challenge is **to share and transmit the embodied insights** with collaborators and participants. Researchers lack common tools to describe, translate, and transmit the experience collected in self-observation and observation of others and to apply it to a design process.

Our central finding is that a particular challenge for the researchers is the verbal articulation of their experiences, despite their understanding that rich embodied experiences can lead to better design of interactive technologies. In order to bridge these gaps within the HCI community, developing specific languages and techniques to organize and explicate communication of embodied insights is essential. Our expert interviewees proposed auto-ethnography, Feldenkrais Awareness through Movement, and LMA. These propositions are an initial articulation of strategies for movement observation in interaction design. We propose that building upon these languages can enrich design strategies for the experiential body within embodied interaction. The question of whether machines can learn these languages and identify components of movement in order to bridge the interface between human-centered design approaches and technologically-driven implementations remains to be seen.

In future works, we will expand the use of LMA to other activities defined within Loke et al.'s framework, including the investigation, invention, reenactment, description, and documentation of movement [24]. LMA allows one to articulate movement from an observational perspective for visually analyzing and representing human movement. It also allows one to acquire experiential data from felt sensation of movement from a first-person perspective, data that can be shared and utilized for the purpose of designing interactions based on human processes and patterns of behavior.

CONCLUSION

This paper investigates the under-explored area of observation of movement experience in interaction design in the context of HCI. We have presented a current state of the art of the existing approaches to observation. We studied the observation practices of three prominent design researchers that focus on the experiential body. We interviewed each of the researchers about how they perform observation and how they articulate the information collected. We correlated their responses with our analysis of a publication they had written that emphasized the use of observation in their design process.

Through our study, we provided two contributions to the HCI community: 1) We articulated three techniques for performing movement observation inspired by somatics and movement studies: attunement, attention, and kinaesthetic empathy. We showed how these techniques are used by these researchers to perform self-observation and observation of others in the design for the experiential body. 2) We articulated the remaining challenges related to describing and translating movement experience in design within HCI. We suggest that there remains a need to address these challenges by further exploring the application of observational movement frameworks from the fields of somatics and movement studies in the context of interdisciplinary research within HCI. However, we recognize that there are multiple techniques for performing observation and for describing movement patterns and highlight that other design researchers within HCI that focus on movement experience may be able to provide additional knowledge about their own strategies and practice.

While our paper is based on existing techniques illustrated in our multidisciplinary literature review, we contribute by bringing them from somatics and articulating them in HCI. Our set of techniques (attunement, attention and kinaesthetic empathy) is directly applicable to the design of embodied design, which has never been proposed in HCI. In further works, we will continue to pursue this work by suggesting specific methods to apply our set of techniques for direct technological implementation. We hope to contribute by further inventing ways to bridge experience and computation within HCI.

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